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EFFECT OF THE POSITION OF THE FLOAT-SIDE ON THE BENDING STRENGTH OF SHEET GLASS

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It is established that the lateral bending strength of sheet glass produced by the float method depends on the position of its float-side with respect to the load applied. If the side contacting tin (the float-side) in bending is in the tension zone, the strength of the glass on the average decreases by 40% compared to its strength when the float-side is in the compression zone. This phenomenon has to be taken into account in designing light-transmitting structures and three-layer glass.

Analyzing the results of lateral bending testing of sheet glass produced by the float method at different Russian factories, it was observed that samples whose side contacting tin (let us call it "the float-side") is oriented toward the tension zone exhibit lower strength than samples with the float-side directed to the compression zone.

To study this phenomenon, we tested ten series of glass samples of size 120 × 35 × 4 mm. Each series consisted of two samples taken from the same glass sheet. Samples with odd numbers in testing were placed with their float side toward the compression zone and samples with even numbers had their float side toward the tension zone. Lateral bending tests using the three-point scheme were carried out on a special test bench. The load was applied stepwise. The load values and the deflection in the center of the sample were measured in testing.

The testing results are indicated in Fig. 1. It can be seen that there is a steady dependence of sheet glass bending strength on its position with respect to the load applied. The decrease in the strength of glass placed with its float size toward the tension zone reaches 50%. The reasons for this phenomenon are not yet studied, however, it can be assumed that the strength variation is related to the temperature regime of glass cooling. The rate of cooling of the surface layer that contacts the gaseous medium is somewhat higher than the rate of cooling of the layer contacting tin, consequently, their structure and strength are different.

The decreased bending strength of sheet glass whose float side is in the tension zone should be taken into account in designing light-transmitting structures, especially in constructing multistoried buildings or producing three-layer glass. In light-transparent enclosures that have at least two glass panes across their thickness, the panes have to be installed with their float side directed outwards. In three-sheet glazing it is advisable to direct the float side of both sheets toward the middle of the multiple pane, since in that place virtually no tensile stresses arise in bending.

The effect of the position of the float side with respect to the load applied should be taken into consideration in determining the strength properties of glass, since substantial dispersion in limiting strength values found in some published sources can be attributed precisely to this reason.

Such undesirable phenomenon as the effect of the float-side position on bending strength of sheet glass can be eliminated by two ways: modifying the temperature regime by increasing the rate of cooling of the surface contacting tin or improving the strength of the float side by applying special strengthening films on glass. However, in the latter case one should bear in mind that the adhesion of the film to glass is slightly impaired.

The strength of surface layers can be increased by their structure modification involving some thermal or chemical treatment, but this concerns other methods of sheet glass strengthening.

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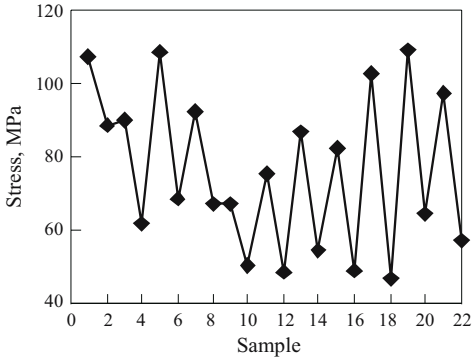

Fig. 1. Maximum stresses in samples tested for lateral bending.